noon, pronounced convection undoubtedly affects the ascensional rate appreciably. After the balloon has risen above this convective turbulence the constant rate is again maintained. As an illustration of an unusually strong convectional influence the two-theodolite observation at Broken Arrow on the afternoon of the 14th is cited. It was found that convection affected the ascensional rate until the 22d minute. However, from the 22d to the 55th minute, the end of the observation, the ascensional rate was almost exactly that of the assumed rate used in single-theodolite work. That conditions extremely favorable for convection were prevalent is shown by the kite records from Broken Arrow on this date and that following. It is found that the lapse rate was particularly steep on these dates, exceeding 2° C. per 100 meters off the surface on the 14th and over 1° C. per 100 meters from the surface to 3,000 on the 15th. Low humidity at these times, however, prevented thunderstorm development.

The observation at Groesbeck on the 24th, referred to above, showed westerly winds from 4,000 to 15,000 meters with an average velocity of about 8 m. p. s. On the 2d, a two-theodolite observation at this station reached to nearly 14,000 meters, indicating moderate easterly winds from 3,000 meters to the highest altitude.

Exceedingly strong winds were observed in the free air as follows: Ellendale on the 7th, W. 39 m. p. s., 7,600 meters; Lansing, W. 31 m. p. s., 8,400 meter; Burlington, WNW. 41 m. p. s., 4,800 meters. It is found that on these dates a high pressure area central over North Dakota on the 7th moved practically due east, being central over Lake Huron on the 9th. In these strong winds undoubtedly lies the reason for the direction taken by this high, since it is oftener found that a more southerly course is followed.

During periods when the Atlantic HIGH was particularly well developed an easterly wind of considerable velocity was observed in the free air at San Juan. This reached 20 m. p. s. at 1,500 meters on the 10th; 23 m. p. s. at 3,500 meters on the 21st; and 23 m. p. s. at

2,000 meters on the 22d.

TABLE 1.—Free-air temperatures, relative humidities and vapor pressures during August, 1923.

	TEMPERATURE (°C.).													
Alti-	Arr	ken ow, da. lm.)	Ne	xel, br. 3m.)	Due S. (217	West, C.	N.I	dale, Dak. m.)	Groes Te (141	beck, x. m.)	Royal Center, Ind. (225m.)			
m. s. l. (m.)	Mean.	De- par- ture from 6-yr. mean.	Mean.	De- par- ture from 8-yr. mean.	Mean.	De- par- ture from 3-yr. mean.	Mean.	De- par- ture from 6-yr. mean.	Mean.	De- par- ture from 5-yr. mean.	Mean.	De- par- ture from 6-yr. mean.		
Surface 250	28. 4 27. 1 25. 9 24. 2 22. 6 20. 9 17. 1 13. 2 9. 3 5. 6 1. 9	+1.5 +1.7 +1.7 +1.3 +1.2 +1.1 +0.9 +0.4 -0.6	21. 1 20. 5 19. 3 18. 1 17. 0 14. 3 11. 4 8. 2 4. 7	-1.0 -0.7 -0.9 -0.9 -0.6 -0.2 +0.1 +0.3 +0.2	26. 8 24. 1 22. 6 20. 5 18. 8 17. 0 13. 7 10. 4 7. 8 5. 2	+1.6 +1.5 +1.7 +1.1 +0.9 +0.7 +0.4 +0.3 +0.5	17.9 17.3 16.3 15.1 13.8 11.5 8.8 5.8	-2.5 -2.2 -2.0 -1.8 -1.6 -1.0 -0.8 -1.0 -1.3	26.3 24.6 23.6 22.6 21.4 20.0 17.0 14.5 11.3 8.0 5.2	+0.4 +0.5 +0.6 +0.7 +0.7 +0.7 +0.7 +0.7 +0.1	22.7 20.1 18.5 16.8 15.1 14.0 11.6 9.2 6.8 4.0	-0.9 -1.3 -1.2 -1.3 -1.5 -1.2 -0.8 -0.7 -0.5 -0.7		
			R	ELAT	IVE	HUMI	DITY	(%).			·			
Surface 250 500 750 1,000 1,250 2,000 2,500 3,000 3,500 4,000 4,500 5,000	56 55 54 54 53 53	10 9 8 7 8 8 7 3 +1 +6 +5	73 67 67 68 68 68 68 63 63	+6 +5 +7 +7 +7 +7 +8 +4 +5 +10	71 73 73 77 78 78 71 70 66 65	0 -1 -2 +1 +1 +1 -2 -3 -7	70 63 61 59 59 55 57 58	+6 +3 +2 +1 +1 +1 +3 +6 +12 +27	59 70 64 55 54 54 55 50 48	-5 -4 -4 -5 -7 -7 -7 -9 -9 -9	65 63 65 62 57 53 46 40 36	0 -2 -3 -1 -4 -8 -9 -9 -10 -10		
				VAPO	R PR	ESSU	RE (1	nb).						
Surface 250	20. 83 19. 13 17. 55 16. 06 14. 58 13. 19 11. 15 9. 32 7. 66 6. 38 4. 90		18. 33 15. 89 14. 59 13. 43 12. 33 10. 72 9. 22 7. 20 5. 91 5. 21	+0.68 +0.65 +0.24 +0.43 +0.54 +0.61 +0.93 +1.15 +0.62 +1.12 +0.81	24. 67 21. 96 20. 02 18. 56 16. 79 14. 84 10. 77 8. 45 7. 00 5. 67 4. 95	+1.99 +2.00 +1.75 +1.48 +1.43 +1.06 +0.69 -0.21 -0.32 -0.32	14. 42 12. 56 11. 31 10. 18 9. 45 7. 68 6. 56 5. 69 5. 20 5. 12	-0.78 -0.79 -0.83 -0.54 -0.27 +0.16 +0.51 +1.02 +1.66 +1.49	23. 07 21. 27 18. 35 15. 84 13. 95 12. 83 10. 64 8. 38 6. 33 4. 46 3. 25	-0.81 -0.82 -0.89 -1.04 -0.99 -1.04 -1.42 -1.64	18. 48 15. 49 14. 04 12. 99 11. 12 9. 47 7. 58 5. 76 3. 76 3. 20	-1.94 -1.54 -1.47 -1.61 -1.29		

TABLE 2.—Free-air resultant winds (m. p. s.) during August, 1923.

			arrow, Okla. Drexel				Nebr. m.)		Due West, S. C. (217 m.)				Ellendale, N. Dak. (444 m.)				Groesbeck, Tex. (141 m.)				Royal Center, Ind. (225 m.)			•
m. s. l.	Mean		6-уеаг ш	ean.	Mean.		8-year m	ean.	Mean	L.	3-year m	ean.	Mean	•	6-year me	an.	Mean	•	5-year m	ean.	Mean		6-year m	lean.
(M.)	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir,	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dr.	Vel.	Dir.	Vel.	Dir.	Vel.
500	8. 25°W. 8. 26°W. 8. 42°W. 8. 53°W. 8. 54°W. 8. 55°W. 8. 60°W. 8. 60°W. 8. 54°W. 8. 54°W. W.	3.2 5.7 6.0 5.7 5.0 4.5 3.7 4.0 6.0	S. 1°W. S. 14°W. S. 20°W. S. 20°W. S. 33°W. S. 49°W. S. 55°W. S. 55°W. S. 55°W.	3.4 4.9 5.6 5.8 5.6 4.9 5.9 7.2 10.2	S. 26° E. S. 3°W. S. 76°W. N. 88°W. W. N. 74°W. N. 65°W.	0.8 1.1 0.5 1.4 2.2 3.5 5.8 0.2 5.5 4.4	S. 8° E. S. 5° W. S. 38° W. S. 52° W. S. 68° W. S. 76° W. S. 84° W. S. 85° W. N. 69° W.	2.1 3.0 3.2 3.4 3.8 5.0 6.3 8.2 9.2 10.6	S. 80°W. S. 76°W. S. 85°W. S. 83°W.	2.3 3.4 3.5 4.0 4.7 6.0 8.7 10.9	N.87°W.	0.3 0.8 0.8 1.3 2.8 4.8 7.9 8.9	N.21° E. N. 17° E. N. 44° W. N. 60° W. N. 66° W. N. 66° W. N. 60° W. N. 60° W. N. 60° W.	1.2 0.8 1.2 2.2 3.6 6.6 10.0 13.2 15.5	S. 29°W. S. 31°W. S. 43°W. S. 56°W. S. 67°W. S. 83°W. N. 80°W. N. 80°W. N. 76°W.	1.1 2.3 2.7 3.2 4.5 9.2 10.8 11.1	S. 2°W. S. 35°W. S. 45° E. S. 45° E. S. 45° E.	4.2 5.5 5.1 8.1 3.0 9.1 11.8 11.8 12.2	N. 32° E	4.1 5.8 5.8 5.4 4.8 3.9 4.0 4.3 4.9 2.8	w. w.	1.4 3.9 6.1 9.0 11.6 12.6 12.5 14.6 16.3	S. 82°W. S. 87°W. W. W. N. 85°W. N. 82°W.	1.7 3.6 4.4 5.6 6.2 6.9 9.1 10.7

THE WEATHER ELEMENTS.

By P. C. DAY, Meteorologist, in Charge of Division.

PRESSURE AND WINDS.

August, 1923, on the whole exhibited no radical departures from the weather to be expected during the last month of summer, although over much of the northern and central portions of the country from the Rocky Mountains eastward the elements favoring the oppressive

weather usually associated with the so-called dog days were largely lacking and pleasant weather was the rule.

The cyclonic circulation continued feeble and the centers of low-pressure areas pursued tracks usually well to the northward from the Great Lakes eastward, only one, that of the 21st-22d, developing the more important cyclonic features.

Anticyclones were of a somewhat stronger type than usually prevail in August, particularly over the western

districts, that of the 21st-22d, moving southward from the Canadian Northwest, being of unusual strength and giving the first warning of approaching winter over northern and central districts from the Rocky Mountains eastward.

In the absence of important low-pressure areas over the southern districts, from Texas eastward, frequently associated with West India hurricanes, the average pressure for the month over this area was higher than in July, although the reverse is usually the case. Likewise on account of the prevalence of low areas along the northern border from the Great Lakes eastward the average pressure for this region was distinctly lower than in July, and here, too, the reverse is usually the case.

For the month as a whole pressure was slightly below normal from the central portions of Kansas and Oklahoma northeastward and eastward to the Great Lakes and Atlantic coast. Elsewhere the pressure averages were

above the normal for the month.

High winds prevailed over extensive areas from the upper Mississippi Valley eastward over the Great Lakes and to the North Atlantic coast on the 21st and 22d, during the passage eastward of the most important storm of the month over those regions. At Buffalo, N. Y., a maximum velocity of 72 miles per hour was recorded on the 21st, the highest ever reported from that point in August.

Except in the above instance high winds were limited to small thunderstorm areas, and as far as reported no lives were lost from storms of the tornado type, and little property damage was sustained from windstorms of any

character.

The prevailing winds were from southerly points over most Atlantic Coast States, and from the Ohio and lower Missouri Valley to the Gulf of Mexico. From the upper Missouri Valley eastward to the Great Lakes the prevailing winds were mainly from northerly or westerly points, while from the Rocky Mountains westward they were variable.

A list of the more important storms of the month, with items pertaining to location, damage, etc., appears at the

end of this section.

TEMPERATURE.

The outstanding feature of the temperature conditions during the month was the unusual cold attending the strong anticyclone that moved into the upper Missouri Valley from the British Northwest on the morning of the 21st, and during the following two or three days overspread the northern and central districts of the United States from the Rocky Mountains eastward. Some of the lowest temperatures ever recorded in August occurred during this period, particularly in the Great Lakes region, and at numerous other points the temperatures were the lowest ever observed so early in the month.

Frosts were reported from exposed localities in the more Northern States, and some damage resulted to

corn, buckwheat, and garden truck.

During the progress southward and eastward of this cold area temperature changes amounting to 20° or more in 24 hours occurred over extensive areas, but otherwise the changes from day to day were usually unimportant.

The following is a statement of the more important features of the temperature conditions existing during

the several weeks of the month:

During the week ending the 7th, high temperatures continued, as had been the case for several previous weeks, over the Central and Southern Plains, the greatest heat centering over Oklahoma and portions of adjacent

States, where the day temperatures were frequently above 100°, reaching a maximum of 112° on the 1st, with weekly averages ranging from 6° to 10° per day above the normal. This week was warm as a rule over practically all other portions of the country from New Mexico northeastward to the Lake Superior region and thence eastward to the Atlantic coast, save over Florida and small areas adjacent thereto. In the upper Missouri Valley and generally to westward of the Rocky Mountains, this week was cooler than normal, the averages for the period ranging from 6° to 12° below normal, from western Minnesota to the eastern portions of Washington and Oregon.

The second week of the month continued warm generally over practically all districts from the Rocky Mountains eastward, the center of the greatest heat still persisting over Oklahoma and parts of adjacent States, with averages about as high as during the preceding week, and extremes still above 100° or only slightly less, and reaching a maximum of 113° in Kansas on the 14th. West of the Rocky Mountains this week showed some increase in warmth, but the averages were still usually

lower than normal.

The week ending the 21st had more veriable temperature conditions than had existed previously during the month, although high temperatures still persisted in the Southern Plains. Over most districts from the Great Lakes eastward the week was moderately cool and similar conditions prevailed in the middle and southern Rocky Mountain and Plateau districts and in the interior portions of California. It was slightly warmer than normal in the far Northwest and the week continued warm in the Great Plains and over most central and southern districts to the eastward.

Beginning with the morning of the 21st unseasonably low temperatures overspread the upper Missouri Valley, and during the following few days decidedly cool weather for August prevailed over most central and northern districts from the Rocky Mountains eastward, the week following the 21st as a whole averaging from 6° to 10° below the normal over all northern districts from the Dakotas and Nebraska eastward to the North Atlantic States. The week was likewise cooler, but not to such a marked degree, over all other portions of the country, save in the Plateau and Pacific Coast States and at a few points in the more Southern States.

The last few days of the month were without important variations in temperature and at the close nearly normal

conditions prevailed in all parts of the country.

The month as a whole was decidedly warm over the near Southwest, the area of greatest heat centering over Oklahoma and the adjacent portions of near-by States. It was likewise warmer than average in the far Northwest and over the Atlantic Coast States from North Carolina to central Florida. Elsewhere the month was cooler than normal, the greatest deficiencies appearing over the more northern districts from the Dakotas eastward.

The warmest periods of the month were mainly during the first half, important dates being on the 1st over Texas, Oklahoma and parts of adjoining States, and in the upper Lake region; on the 3d to 5th over the Northeastern States; about the 10th to 12th from the middle Rocky Mountains eastward to the Ohio Valley; about the 15th to 18th in the central and east Gulf States and in the far Northwest; and near the end over California, Arizona and portions of adjoining States.

The coolest period of the month was confined chiefly to the early part of the last decade, mainly on the 22d-24th. Over the districts from the Rocky Mountains

westward the coolest days were widely scattered.

PRECIPITATION.

The rainfall during the month was probably near the normal considering the country as a whole, though poorly distributed as a rule. In general there was less than the normal amount from central Montana and northern Wyoming eastward to the Great Lakes, over the Atlantic States from Maine to Florida, and over the Great Plains from the southern portions of Kansas and Missouri to the Gulf and Rio Grande. Over the Plateau States and from the middle Rocky Mountains eastward to Lake Michigan and the Ohio Valley the precipitation was above normal, usually by considerable amounts. In eastern Colorado and portions of Nebraska, South Dakota and Iowa rains were frequent and heavy, and the totals for the month were in many cases the greatest of record for August. In Colorado rain occurred in some portions of the State on every day of the month, and the total for the State was the greatest ever known in August.

The greatest monthly fall at any station was 14.30 inches at Georgetown, S. C., and amounts above 10 inches were reported from one or more points in nearly half the States. The range between the greatest and

least amounts was unusually large, thus indicating a very uneven distribution within the States.

SNOWFALL.

Snow was reported from some of the mountains of Wyoming and Montana, on the 1st, but records available do not show that it occurred elsewhere.

The supply of water for irrigation and hydroelectric power in California was low, but sufficient for present needs. Elsewhere in the West the supply of water was generally sufficient.

RELATIVE HUMIDITY.

On account of the prevailing high temperatures in portions of the middle and southern Great Plains, the relative humidity over this area ranged from 5 to 15 per cent less than normal, and there was a general deficiency from the upper Mississippi Valley eastward to New England. In other parts of the country more humid conditions prevailed and there was a decided excess in the Rocky Mountain and portions of the Plateau regions.

SEVERE LOCAL STORMS, AUGUST, 1923.

[The table herswith contains such data as have been received concerning severe local storms that occurred during the month. A more complete statement will appear in the Annual Report of the Chief of Bureau.]

Place.	Date.	Time.	Width of path (yards).	Loss of life.	Value of prop- erty de- stroyed.	Character of storm.	Ramarks.	Authority.
Modena, Utah (near)	1	P. m				Thunderstorm and	High water resulted in washing out fences and crops and overflowing railroad track.	Official, U. S. Weather Bu- reau.
Yankton, S. Dak., and vicinity.	3	9:35-10:50 p. m.				Thunderstorm	Much damage to wires and poles, trees, and signs; minor damage to some buildings; corn blown down; 2 persons injured.	Official, U. S. Weather Bu- reau. Press and Dakotan (Yankton, S. Dak.).
Garden City, Kans	4	P. m				Wind and hail	Crops severely damaged	(Yankton, S. Dak.). Official, U. S. Weather Bu- reau.
Leoti, Kans	4	5 p. m	1			Tornado	Whole town practically destroyed; several persons injured.	Official, U. S. Weather Bu- reau. Wichita Beacon.
Terre Haute, Ind., and adjacent country.	4	5-8 p. m		•••••		Thunderstorm	Communication crippled and car service inter- rupted for several hours; other minor damage.	Official, U. S. Weather Bu- reau. Star (Terre Haute,
Beech Grove, Ky.(vicinity of) Central Illinois	4 4-5	A. m				Wind and rain Electrical and wind.	Considerable damage to barns and crops	Inquirer (Owensboro, Ky.) Official, U. S. Weather Bu-
West Springfield, Mass	5	2:30 p. m	67	·····		Tornado	broken; other minor damage. Many buildings demolished and others unroofed and some minor property damage; a number of people were injured; length of path one-half mile.	(Springfield, III.). Official, U. S. Weather Bu- reau. Springfield Daily Republican.
Bridgewater and Middleboro,	5		 	 -		Wind		Official, U. S. Weather Bu- reau.
Mass. Charles City, Iowa, and vi- cinity.	6	7:45-9 p.m.			\$ 8,000	Thunderstorm	Residence damaged, and barn destroyed by	Do.
Nashville, Tenn	6	ļ			 	Electrical and wind.	700 poles disabled, traffic suspended, and several	Do.
Terre Haute, Ind St. Louis, Mo	7–8 8					Thunderstorm	700 poles disabled, traffic suspended, and several buildings slightly damaged. Much damage by wind and lightning	Do. Do.
Chicago, Ill							Several persons and a number of buildings	Do.
Dubuque, Iowa	11 12 12	10 p. m A. m. 7:52-9:47			20,000	Wind Wind and hail Thunderstorm	Details not reported	Do. Do. Do.
Concordia, Kans., and vicinity	14	7:52-9:47				do	Chimney destroyed by ligthning; 6 head of cat- tle killed.	Do.
Memphis, Tenn	17	p. m. 7–8 p. m		·		. Electrical and rain		Do. Commercial Appeal (Ten- nessee).
Niagara and Orlean Counties, N. Y.	21			1		L	Fruit crops heavily damaged; some minor damage.	Official, U. S. Weather Bureau.
Indianapolis, Ind	21	1-4 p. m				Thunderstorm	Communication lines disabled; trees and signs blown down; several killed or injured by lightning; many streets and basements flooded.	Do.
Rochester, N. Y	21	P. m				. Wind		Do.
Cincinnati, Ohio	26	P. m	.		.	Thunderstorm	Damage principally to windows, lamps, and skylights.	Do.
Indianapolis, Ind	27	A. m	.		.		Two barns struck by lightning; some damage to wires.	Commercial Tribune (Ohio) Official, U. S. Weather Bureau.
Levy, N. Mex	27	P. m	.] <i></i>			Wind, rain, and		The Journal (Albuquerque, N. Mex.).
Chicago, Ill	27	A. m		· ····	·		Telephone and electric power lines torn down; basements and subways flooded; numerous fires reported from lightning.	Daily Journal (Chicago, Ill.)
San Francisco, Calif. (vicinity of).	28		·	·	. 500,000	Thunderstorm	fires reported from lightning. Standard Oil tanks in San Pablo struck by lightning; minor damage in other near by points.	Official, U. S. Weather Bureau.
Savannah, Ga	30					. Wind		Do.